

where a is the length hanging over at the commencement of the motion. If $a=0$, then the equation is

$$\frac{ds}{\sqrt{s}} = \sqrt{\frac{2g}{3}} dt,$$

and integrating from $t=0$, $2\sqrt{s} = \sqrt{\frac{2g}{3}} t$, or finally $s = \frac{1}{6} gt^2$, so that the motion is the same as that of a body falling under the influence of a constant force $\frac{1}{3}g$. It is perhaps worth noticing that the differential equation may be obtained as follows:—We have, in the first instance, a mass s moving with a velocity s' , and after the particle ds ($=s'dt$) has been set in motion, a mass $s+s'dt$ moving say with a velocity $s'+\delta s'$, whence neglecting for the moment the effect of gravity on the mass s , the momentum of the mass in motion will be constant, or we shall have

$$ss' = (s+s'dt)(s'+\delta s') = ss' + s'^2 dt + s\delta s',$$

and therefore $s\delta s' = -s'^2 dt$. Hence, adding on the right-hand side the term $gsdt$ arising from gravity, and substituting $\frac{d^2s}{dt^2} dt$ for $\delta s'$,

we have the equation $s \frac{d^2s}{dt^2} = gs - \left(\frac{ds}{dt}\right)^2$ as before.

IX. "Remarks on a New Class of Alcohols." (Second Note.)

By A. W. HOFMANN, LL.D., F.R.S., and AUGUSTE CAHOURS, F.C.S. Received May 15, 1857.

(Abstract.)

In a communication addressed to the Royal Society some time ago (Proceedings, vol. viii. No. 19), we endeavoured to delineate the characters of a new alcohol—the Allylic alcohol, which is the prototype of a new class of alcohols. We have since continued these researches in order to complete the history of this remarkable compound.

In submitting to the Royal Society the full account of our experiments upon the subject, we beg leave to mention in this abstract briefly some additional compounds which we have examined since our last communication.

Sulphide of Allyl (Garlic Oil), $C_{12}H_{10}S_2$.—When iodide of allyl is allowed to fall drop by drop into a concentrated alcoholic solution of protosulphide of potassium, a very energetic action ensues, the liquid becomes very hot, and an abundant crystalline deposit takes place of iodide of potassium. It is important that the iodide of allyl should only be added gradually to avoid spitting, by which a part of the product would be lost. As soon as the action ceases, the liquid is mixed with a slight excess of sulphide of potassium; addition of water now separates a light yellowish limpid oil possessing a strong smell of garlic. When rectified, this liquid becomes colourless, it boils at $140^\circ C.$, and gives with nitrate of silver a crystalline precipitate soluble in a boiling mixture of alcohol and water, and separating from this solvent in the form of beautiful white needles, absolutely identical with those which the natural essence of garlic produces. Sulphide of allyl also comports itself with corrosive sublimate and with bichloride of platinum exactly like the natural garlic oil.

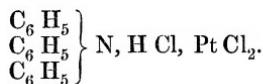
Allyl-Mercaptan, $C_6H_6S_2$.—When in the process for the preparation of the preceding compound the protosulphide of potassium is replaced by the hydrosulphate of sulphide of potassium, a volatile product is obtained, having a similar but more ethereal odour. This substance acts with energy upon protoxide of mercury, with which it forms a compound, dissolving in boiling alcohol, and separating from it on cooling in the form of pearly scales of remarkable brilliancy, which present the greatest resemblance to the mercaptide of mercury. The liquid obtained in the above-mentioned reaction boils at 90° , and possesses a composition and an aggregate of properties which closely resemble those of the mercaptan of the ethyl-series, being, in fact, the allylic mercaptan, $C_6H_6S_2$.

Allylamine, C_6H_7N .—By boiling cyanate of allyl ($C_8H_5NO_2$) with a concentrated solution of caustic potassa until the oily layer entirely disappears, a complete decomposition ensues, and the residue contains only a mixture of carbonate of potassium with an excess of the alkaline hydrate; the volatile products condensed in hydrochloric acid furnish a saline mass which may be obtained crystalline on evaporation. This substance is always a mixture, the constituents of which vary both in nature and properties. The action of potassa on it not only separates a base, which is readily soluble in water, but

also insoluble basic oils, the boiling-point of which rises to 180° C. Simple distillation of the liberated bases appears to give rise to decompositions, and thus to induce further complication. We have not succeeded in ascertaining with perfect precision the nature of this mixture, but we have found that it invariably contains a considerable quantity of a base which bears the same relation to allylic alcohol that is observed between ethylamine and ordinary alcohol. The formation of this substance, which we propose to designate allylamine, $C_6 H_7 N$, is perfectly analogous to the production of ethylamine by means of cyanate of ethyl.

Diallylamine, $C_{12} H_{11} N$.—Impure allylamine, obtained by the action of potassa on the cyanate, when digested with a second quantity of iodide of allyl is rapidly changed into a mass of hydriodates of new compounds. This crystalline mass evidently contains a considerable quantity of the hydriodate of diallylamine, but to succeed in separating it from this very complicated mixture would have required a more considerable quantity of substance than we had at our disposal.

Triallylamine, $C_{18} H_{15} N$.—The oxide of tetrallylammonium, to which we shall presently allude, submitted to the action of heat, is decomposed, with liberation of a basic oil. The perfect analogy of the oxide of tetrallylammonium with the corresponding ethyl-compound, leaves no doubt respecting the nature of this basic substance. It is obviously triallylamine. When saturated with hydrochloric acid and mixed with bichloride of platinum, it deposits a yellow platinum-salt, the analysis of which leads to the formula

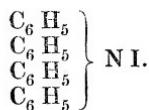


Oxide of Tetrallylammonium, $C_{24} H_{20} NO, HO$.—The chief product of the action of ammonia upon iodide of allyl is a magnificent crystalline compound, which is deposited from the solution resulting from the reaction. Iodide of allyl is rapidly attacked even by an aqueous solution of ammonia at the common temperature. By a few days' contact a large quantity of the iodide dissolves, and the solution becomes a solid mass. If no deposition of crystals take place from the solution, it is only necessary to add a concentrated solution of caustic potassa, which causes the separation of an oily layer that

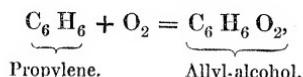
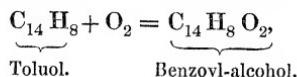
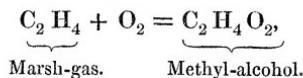
speedily solidifies. The crystals thus formed are the iodide of tetrallylammonium, which, like the corresponding compound of the ethyl-series, is but slightly soluble in solution of potassa. It is obtained pure by exposing it to the air until the potassa is converted into carbonate, and then recrystallizing it from absolute alcohol.

The iodide, by treatment with oxide of silver, is immediately transformed into the oxide. This forms an alkaline solution, which possesses all the properties of the oxide of tetrethylammonium.

The iodide contains

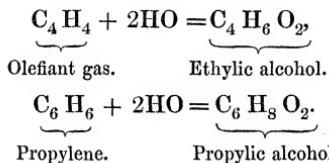


On taking a retrospective glance at the results obtained in this inquiry, it is obvious that propylene, a homologue of olefiant gas, is susceptible of furnishing a mono-acid alcohol, which bears to it the same relation that is observed between methyl-alcohol and marsh-gas, or between benzoic alcohol and toluol, the analogue of marsh-gas among the derivatives of the aromatic acids. The hydrocarbons homologous and analogous to marsh-gas, the homologues of olefiant gas, and indeed probably a very considerable number of other hydrocarbons, may be regarded as starting-points for the production of mono-acid alcohols and of all their derivatives. All these alcohols are formed by the fixation of two equivalents of oxygen, which oxidation, however, cannot be effected directly, but is accomplished by a series of substitution-processes.



But olefiant gas and its homologues are capable of furnishing mono-acid alcohols by another reaction, which has not yet been

applied to the series of bodies homologous to marsh-gas. In fact, we have learnt by the beautiful researches of M. Berthelot that olefiant gas and its homologues are capable of being transformed into alcohols by the absorption of two equivalents of water ; olefiant gas furnishes by this reaction ordinary alcohol, and propylene, allylic alcohol ; thus—



Olefiant gas, then, and all its homologues are capable of furnishing *two* mono-acid alcohols, exhibiting slightly different features, but presenting in all their principal characters the most obvious analogy. The alcohols formed by fixation of water, such as ethylic alcohol, have long been well known ; in fact, the detailed study which has been made during the last quarter of a century of most of their derivatives, has exercised the most beneficial influence upon the development of organic chemistry.

The same remark does not apply to the alcohols produced from these same hydrocarbons by fixation of oxygen. The history of allylic alcohol, which we have endeavoured to trace in the preceding pages, and to which of late important contributions have been furnished, moreover, by MM. Berthelot and De Luca and by M. Zinin, begins to throw light also upon this second group of alcohols. For this reason the discovery of allylic alcohol appears to claim the attention of chemists, even if it had not assisted in fixing, in the system of organic compounds, the exact position of several very interesting natural products, viz. the sulphuretted oils furnished by the bulbs of the garlic (*Allium sativum*) and the seeds of the black mustard (*Sinapis nigra*), which it had not been possible up to the present time to group around a similar centre.